

FOUR NEW PUPFISHES OF THE GENUS *CYPRINODON* FROM MEXICO, WITH A KEY TO THE *C. EXIMIUS* COMPLEX

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ABSTRACT: The pupfishes (genus *Cyprinodon*) referable to the *C. eximius* complex comprise seven species that are restricted to, or had their origin in, the Chihuahuan Desert region of México and adjacent parts of Texas and New Mexico. Four are described as new; the remainder are *C. eximius*, *C. atrorus*, and *C. latifasciatus*. Most are of restricted distribution; one is extinct and another may be. Keys, diagnoses, and ranges are given for each species and all are illustrated. The distinctive morphometric characters of the new species are given. Life colors and color patterns are important in distinguishing species.

More than fifty years ago, while on the staff of the Field Museum of Natural History, Carl L. Hubbs began to gather data for an intended revision of the genus *Cyprinodon* (Hubbs, 1926: 17). He subsequently described the distinctive Yucatán pupfish, *C. variegatus artifrons* (Hubbs, 1936: 223–225, pl. 6, figs. 1–5). About this time I independently became interested in this genus and we decided to work together on it (Hubbs and Miller, 1941: 2). We did jointly describe a new species from the Bahamas (Hubbs and Miller, 1942) but in the 1950's Carl turned over to me all of his notes on *Cyprinodon*. These include helpful information on some of the species that are treated herein, including the significant observation that colors and color pattern are important specific traits.

The group of seven species (four new) included in this paper comprises those pupfishes believed to be closely related to *Cyprinodon eximius* Girard, the most widely distributed species of the complex. All are inhabitants of, or originated from ancestral stocks in, the Chihuahuan Desert region (Basin and Range Province) of northern México and adjacent parts of Texas and New Mexico (Miller, 1976b). They are distinguished in the following key.

A KEY TO THE PUPFISHES OF THE *CYPRINODON EXIMIUS* COMPLEX

1. a. Terminal black bar on caudal fin of nuptial male broad, wider than pupil, about 1.2–1.6 in orbit 2
- b. Terminal black bar on caudal fin of nuptial male of usual width for *Cyprinodon*, subequal to or less than diameter of pupil 6
2. a. Pelvic fins rather small and mandible long, the pelvic length entering mandible length more than 1.0 times *C. alvarezii*, n. sp. (Fig. 1D) El Potosí, Nuevo León
- b. Pelvic fins not reduced and mandible not elongated, the pelvic length entering mandible length less than 1.0 times 3
3. a. Caudal fin of nuptial male with prominent black spots or dashes on interradiar membranes of basal $\frac{1}{2}$ to $\frac{2}{3}$ of fin, usually irregularly arranged but sometimes aligned in about 3 vertical rows; terminal black bar immediately preceded by a narrower light bar *C. eximius* (Fig. 1A) Río Conchos Basin, etc.
- b. Caudal fin of nuptial male without conspicuous black markings on interradiar membranes; no light bar immediately preceding terminal black bar 4
4. a. Gill rakers 12–17; mandibular pores 0–2; scales around caudal peduncle usually 20 (uncommonly 16) *C. nazas*, n. sp. (Fig. 1C) Río Nazas Basin, Santiaguillo Basin
- b. Gill rakers 20–28; mandibular pores lacking; caudal peduncle scales 16 (rarely 15 or 17) 5
5. a. Ocellus on dorsal fin lacking in both sexes; lacrimal pores typically 3 (2–4); dorsal fin of nuptial male not yellow or orange; body of male with dark lateral stripe from behind eye to caudal base, set off above by a narrow silvery stripe (turquoise in life?) and below by a broad yellowish stripe *C. latifasciatus* (Fig. 1G) Parras Basin, Coahuila
- b. Ocellus present on dorsal fin of both sexes; lacrimal pores lacking; dorsal fin of nuptial male yellow or orange; body of male with 7–9 broad vertical bars *C. atrorus* (Fig. 1B) Cuatro Ciénegas Basin, Coahuila
6. a. Scales in lateral series 23 or 24; gill rakers 17–22; dorsal fin of nuptial male yellow; vertebrae usually 25 *C. macrolepis*, n. sp. (Fig. 1F) Ojo Hacienda Dolores, Chihuahua
- b. Scales in lateral series typically 25; gill rakers 12–15; dorsal fin of nuptial male not yellow; vertebrae 26 or 27 *C. meeki*, n. sp. (Fig. 1E) Río Mezquital Basin, Durango

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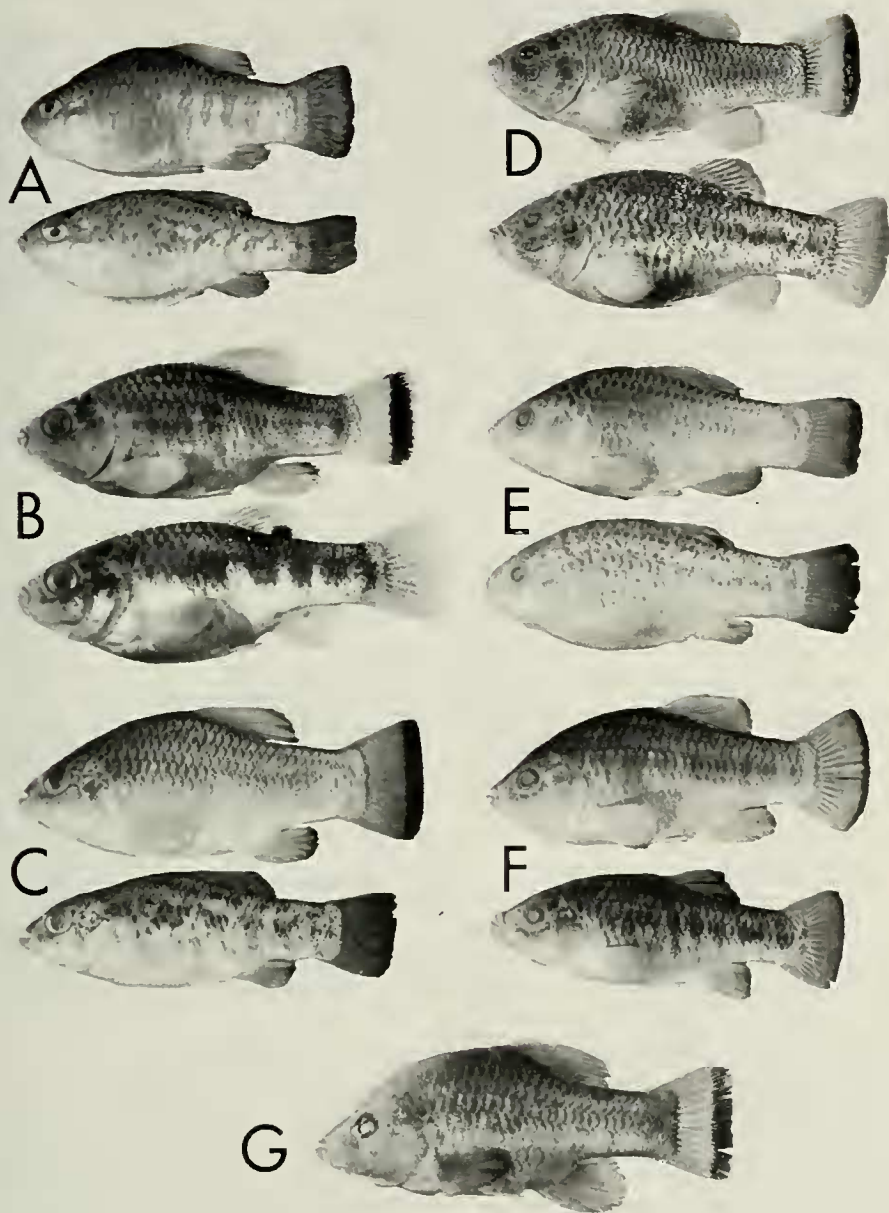


Figure 1. Seven species of *Cyprinodon* from México. A, *C. eximius*, Río Conchos at Jiménez, Chihuahua (FMNH 3556); nuptial male, 34.0, above, adult female, 34.4, below. B, *C. atrorus*, Laguna San Pablo, Cuatro Ciénegas bolsón, Coahuila (UMMZ 179846-47); nuptial male, 29.3, above, adult female, 31.8, below. C, *C. nazas*, new species, Río Nazas at San Miguel, Coahuila; male holotype (UMMZ 197419), 39.5, above, female paratopotype (UMMZ 196712), 36.3, below. D, *C. alvarezii*, new species, El Potosí, Nuevo León; male holotype (UMMZ 179638), 37.4, above, female paratopotype (UMMZ 179639), 40.3, below. E, *C. meeki*, new species, spring-fed pond near Durango City, Durango; male holotype (UMMZ 197420), 37.6, above, female paratopotype (UMMZ 166709), 37.6, below. F, *C. macrolepis*, new species, Ojo de la Hacienda Dolores, Chihuahua; male holotype (UMMZ 168982), 38.9, above, female paratopotype (UMMZ 168983), 36.4, below. G, *C. latifasciatus*, Parras, Coahuila; nuptial male lectotype (MCZ 37995), 37.3.

The members of the *Cyprinodon eximius* complex may be tentatively diagnosed by the following combination of traits: black or dark brown terminal bar on caudal fin of nuptial male broad, wider than pupil and occasionally as wide as eye (exceptions in *macrolepis* and *meeki*); gill rakers typically fewer than 20 on first gill arch, including all rudiments (*atrurus* and *latifasciatus* have 20–28, and *macrolepis* commonly has 20); dorsal fin of nuptial male yellow, orange, or amber (*latifasciatus*, *meeki*, and *alvarezii* are exceptions); mandibular pores lacking (except *alvarezii*, with 2, and *nazas*, with 0–2); cleithral process enlarged, its posterior margin extending beyond second scale of lateral series (exceptions in *atrurus*, *latifasciatus*, and *macrolepis*); pelvic fins modally with 6 rays (6 or 7 in *eximius* and *nazas*).

In addition, Liu (1970) has referred to data in his thesis indicating that there are differences in courtship behavior between this species complex and others in *Cyprinodon*. Those proportional measurements that show significant differences between the new species and *C. eximius* are given in Table 1, but to what extent these or other measurements may possibly characterize this complex has not been determined. All measurements are in millimeters.

Cyprinodon eximius Girard
Conchos pupfish
Figure 1A

Cyprinodon eximius Girard, 1859, Proc. Acad. Nat. Sci. Phila., 11: 158 (orig. descr., Chihuahua River = Río Chuviscar, at Chihuahua City, México).

Cyprinodon elegans (misidentification) Woolman, 1894, Bull. U. S. Fish Comm., 14 (1895): 59–60 (descr. of female of *eximius* separately from male, which was correctly identified as *eximius*; Río de los Conchos, Chihuahua City). Garman, 1895, Mem. Mus. Comp. Zool., 19 (1): 23–24 (Chihuahua material only). Meek, 1904, Field Colombian Mus. Publ. 93, Zool. Ser., 5: 125 (material from San Diego, Chihuahua, only). Jordan, Evermann, and Clark, 1930, Rept. U. S. Comm. Fish. for 1928, Pt. II: 181 (*eximius* wrongly synonymized with *elegans*).

Cyprinodon bovinus (misidentification) Regan, 1906–08, Biologia Centrali-Americana, 8: 84 (*eximius* wrongly synonymized with *bovinus*, which is restricted to Texas—see Echelle and Miller, 1974, Southwest. Nat., 19: 179–190, fig. 1). Fowler, 1916, Proc. Acad. Nat. Sci. Phila., 68: 429 (syntype of *eximius* listed in synonymy of *bovinus*). Buen, 1947, An. Inst. Biol. Méx., 18 (1): 277

(*eximius* synonymized with *C. b. bovinus*; records for Río Conchos and Río Sauz only).

Diagnosis.—Dorsal fin of nuptial male yellow to yellow-orange in life, the terminal black caudal-fin bar broad (much wider than pupil); basal one-half to two-thirds of caudal fin of adults with checkered pattern of prominent black spots and dashes on interradiial membranes; gill rakers 12–18, usually 13–16 but 11–14 in Sauz basin; lateral scales usually 26 or 27, those around caudal peduncle 16; vertebrae usually 27 or 28; pelvic rays 6 or 7; mandibular pores consistently lacking; dorsal ocellus present in females and juveniles; cleithral process enlarged, its posterior margin extending beyond second scale in lateral series; first dorsal ray thickened, spine-like; branchiostegals 6.

Distribution.—This species inhabits the basin of Río Conchos, tributary to Río Grande, that of the endorheic Río Sauz basin (see Minckley and Koehn, 1965), and the following Río Grande tributaries that lie east of the mouth of Río Conchos: Alamito Creek, Presidio County, Texas; Río Alamo, Chihuahua, across from Alamito Creek (UMMZ 196768); Tornillo Creek, Brewster County, Texas (W. L. Minckley, collector); and Devil's River basin (including Dolan Creek), Val Verde County, Texas. Meek (1904, op. cit.: 125) erred in listing Jordan and Snyder's questionable record of *elegans* from Tampico lagoons as this species (it is *C. variegatus*); also, his records for San José and Ahumada pertain to an undescribed pupfish. *C. eximius* was also listed (Contreras-Balderas, 1969: 297) from Laguna de Bustillos, an endorheic basin west of Chihuahua City, but that record represents an undescribed species.

Distinctive populations occur in parts of the extensive range of this species (as in the Sauz-Encinillas basin, Río Grande tributaries above Big Bend National Park, and Devil's River basin) but probably none of them is more than subspecifically distinct.

Cyprinodon atrurus Miller
Bolsón pupfish
Figure 1B

Cyprinodon atrurus Miller, 1968, Occas. Pap. Mus. Zool. Univ. Michigan 659: 7–12, fig. 2 (orig. descr., Cuatro Ciénegas bolsón, Coahuila, México).

Diagnosis.—Dorsal fin of nuptial male yellow to orange in life, the terminal black caudal-fin bar very broad (almost as wide as eye), the interradiial membranes of rest of fin free of melanophores in both sexes; mandibular and lacrimal head pores lacking and preopercular pores usually only 3–6 (typically 4); female and juvenile with well-developed ocellus on both dorsal and anal fins; pelvic with 6 rays, fin not reaching beyond anal origin in either sex; gill rakers 20–25; branchiostegals 5, rarely 6; lateral scales 25 or 26, those around caudal peduncle 16; vertebrae 26 or 27; cleithral process moderately enlarged; first dorsal ray not notably different from second.

TABLE 1. Proportional measurements in permlage of standard length in five Mexican species of *Cyprinodon*.

Measurement	<i>C. eximius</i> ¹		<i>C. macrolepis</i> ²		<i>C. abvarezii</i> ³		<i>C. nassasi</i> ⁴		<i>C. meeki</i> ⁵	
	11 ♂	10 ♀	10 ♂	10 ♀	10 ♂	10 ♀	10 ♂	10 ♀	10 ♂	10 ♀
Standard length	28.1-39.8 (34.2)	26.7-38.5 (32.1)	27.5-41.4 (33.9)	26.4-37.0 (32.2)	26.6-41.1 (35.4)	25.6-39.5 (33.5)	26.8-40.6 (34.1)	25.6-39.9 (33.4)	26.3-41.9 (33.5)	25.5-38.9 (33.5)
Predorsal length	548-601 (570)	553-590 (567)	569-625 (593)	584-616 (606)	559-596 (577)	574-598 (585)	540-583 (553)	543-576 (555)	548-578 (566)	565-602 (584)
Anal origin to caudal base	370-408 (390)	351-375 (363)	370-393 (379)	330-351 (343)	341-387 (370)	344-375 (357)	372-421 (393)	354-391 (370)	383-411 (398)	353-382 (368)
Body depth	445-500 (473)	378-481 (426)	393-456 (427)	362-440 (388)	390-474 (435)	383-445 (409)	384-461 (427)	367-406 (389)	414-480 (446)	396-457 (430)
Head depth	306-335 (327)	306-331 (320)	333-359 (345)	312-326 (319)	338-357 (348)	305-374 (330)	324-363 (343)	305-330 (320)	354-388 (368)	337-386 (362)
Caudal-peduncle length	256-274 (265)	234-262 (247)	239-257 (249)	230-249 (237)	232-271 (254)	227-254 (241)	243-271 (260)	227-270 (255)	261-288 (272)	241-262 (254)
Interorbital, bony width	116-130 (123)	113-123 (119)	137-154 (143)	137-151 (146)	111-130 (120)	112-125 (119)	108-125 (116)	106-120 (113)	120-132 (124)	116-129 (122)
Mouth width	113-126 (119)	112-124 (118)	119-137 (126)	126-143 (132)	110-124 (116)	109-134 (120)	104-121 (112)	105-120 (112)	103-128 (116)	115-137 (125)
Mandible length	98-117 (107)	99-111 (106)	85-114 (101)	87-105 (91)	107-124 (114)	109-122 (114)	95-103 (99)	93-102 (97)	85-111 (101)	97-109 (104)
Dorsal fin, basal length	192-235 (217)	189-228 (204)	191-221 (206)	170-197 (185)	185-225 (203)	158-203 (187)	200-253 (224)	181-209 (201)	167-212 (187)	144-181 (168)
Depressed length	305-370 (340)	277-310 (293)	287-342 (313)	252-289 (266)	277-320 (298)	257-284 (271)	317-379 (337)	268-291 (284)	289-346 (313)	229-273 (256)
Pectoral length	244-271 (259)	234-261 (249)	234-253 (241)	203-227 (213)	212-238 (224)	204-239 (218)	245-274 (260)	232-258 (243)	224-251 (236)	226-248 (235)
Pelvic length	121-136 (131)	113-122 (118)	91-113 (100)	72-93 (85)	90-109 (98)	86-103 (93)	116-127 (122)	98-123 (111)	106-123 (117)	103-111 (107)

¹ FMNH 3556, Jiménez, Chihuahua.² UMNZ 168982, 168983.³ UMNZ 179638, 179639, 189021.⁴ UMNZ 197419, 196712.⁵ UMNZ 197420, 166709.

Distribution.—Restricted to the bolsón of Cuatro Ciéneas, Coahuila, México (see Minckley, 1969).

Cyprinodon latifasciatus Garman
Parras pupfish
Figure 1G

Cyprinodon latifasciatus Garman, 1881, Bull. Mus. Comp. Zool., 8 (3): 92 (orig. descr., spring near Parras, Coahuila, México). Miller, 1964, Southwest. Nat., 9 (2): 62–67 (species redescribed and figured; synonymy).

Cyprinodon bovinus latifasciatus (misidentification) Buen, 1947, An. Inst. Biol. Méx., 18 (1): 277 (synonymized with *bovinus*; Parras record only).

Diagnosis.—Dorsal fin of nuptial male dusky, probably not yellow in life (species extinct), the terminal black caudal-fin bar very broad (much wider than pupil), the interradial membranes of remainder of fin clear in both sexes; male with broad, dark lateral stripe from behind eye to base of caudal fin, set off above by a much narrower silvery band (turquoise in life?) and below by a broader yellowish stripe beneath which is a less distinct brownish stripe about same width as dorsal counterpart; female similar in body color pattern; no dorsal ocellus in either sex; pelvic fins small, 6-rayed, not reaching origin of anal fin; gill rakers 22–28; cleithral process little enlarged, not extending beyond posterior margin of second scale in lateral series; mandibular pores lacking; branchiostegals 5; first dorsal ray thickened.

Distribution.—Known only from the Parras basin, Coahuila, México, where now extinct.

Cyprinodon nazas, new species
Nazas pupfish
Figure 1C

Cyprinodon latifasciatus (misidentification) Meek, 1904, op. cit.: 126–127 (reference to Río Nazas, as part of range, only).

Diagnosis.—Dorsal fin of nuptial male yellow, yellow-orange, or amber in life, the terminal black caudal-fin bar broad (wider than pupil), the interradial membranes of remainder of fin clear in both sexes; gill rakers 12–16, rarely 17; mandibular pores irregularly developed, 0–2; scales around caudal peduncle 16–20, and around body 28–38, usually 30–36; cleithral process enlarged and thickened, its posterior margin extending beyond posterior border of second scale in lateral series; first dorsal ray thickened, spine-like; lacrimal pores typically 4; ocellus on dorsal fin of female and juvenile weak to lacking; brachiostegals 6.

Holotype.—UMMZ 197419, a nuptial male 39.5 mm in standard length (SL) from Río Nazas near its mouth at San Miguel, 7 km SSE of San Pedro de las Colonias, near edge of Laguna Mayrán, Coahuila, salinity 8.2 ppt, elev. 1,093 m; collected by R. R. and F. H. Miller, 23 March 1974. There are 207 juvenile

to adult paratopotypes, UMMZ 196712, 14–46 mm SL, taken with the holotype. Additional paratypes are: UMMZ 166707, 175 young to adult, 18–37 mm, and CAS 33902, 394 from same collection, Río del Peñón del Covadonga at La Concha, 8 km SW of Peñón Blanco, Durango (elev. 1,730 m); TU 30616, 26 young to adult, 12.5–33 mm, from same stream ca. 3.2 km E of Peñón Blanco; CAS 33903, 6, 22–46 mm from Peñón Blanco; UMMZ 161674, 124 juvenile to adult, 24–45 mm, Río Trujillo (locally Río Florido), 1.6 km W of Rancho Grande, Zacatecas (trib. Río Aguanaval); USNM 132618, 5 adults, 29–38.5 mm, Río Nazas, 24 km SW of Lerdo, Durango.

Fin rays: dorsal 10–12, usually 10 or 11; anal 9–11, usually 10; pectoral 15–17, usually 16; pelvic 6–7, rarely 5; caudal 16–19, usually 16 or 17. Lateral scales 25–27, usually 26; dorsal to anal 12–14, usually 13; around caudal peduncle 16–20, usually 20 but frequently 18 or 19; around body, 28–38, usually 34–36 except in the Santiaguillo basin (see below). Gill rakers 12–17, frequently 14. Vertebrae (total, including hypural complex as one) 26–28, typically 27. Head pores: mandibular 0–2, frequently 0, usually 2; lacrimal 2–5, typically 4; preopercular 6–10, typically 7. Branchiostegals 6.

Measurements of holotype in thousandths of standard length: predorsal length 562, prepelvic length 557, preanal length 681, anal origin to caudal base 405, dorsal origin to caudal base 532, body depth 458, body width 251, head length 327, head width 251, head depth 357, caudal-peduncle length 271, caudal-peduncle depth 215, bony-interorbital width 114, snout length 101, orbit length 86, mouth width 114, mandible length 99, depressed-dorsal length 354, basal length of dorsal 233, depressed-anal length 258, basal length of anal 139, length middle caudal rays 238, pectoral length 256, basal width of pectoral 99, pelvic length 122.

Distribution.—This species occurs in the basin of Río Nazas, including that of Río Aguanaval which evidently joined the Nazas in Laguna Mayrán within historic time, and in the endorheic basin of Laguna Santiaguillo, about 75 km N of Durango City. (See Fig. 1 in Conant, 1963.)

The population of *C. nazas* inhabiting the Santiaguillo basin is probably worthy of subspecific recognition, in part on the basis of fewer scales around the caudal peduncle (usually 16) and around the body (usually 30–32).

Cyprinodon alvarezii, new species
Potosí pupfish
Figure 1D

Cyprinodon sp. Miller and Walters, 1972, Contrib. Sci. Nat. Hist. Mus. Los Angeles Co., 233 (habitat, size frequency, feeding habits, relative abundance, relationship to *C. eximius*).

Diagnosis.—Dorsal fin of nuptial male white or

milky or bluish white, the terminal black caudal-fin bar broad, wider than pupil, the interradiial membranes of rest of fin immaculate in both sexes; body of breeding male typically without vertical bars; mandible long, the lower jaw prominent; pelvic fin reduced; lateral scales 24–26, usually 25; gill rakers 16–20, typically 17–19; vertebrae 26–27, predominantly 26; mandibular pores consistently 2; branchiostegal rays 5 or 6; scales around caudal peduncle 14–16, typically 16, and around body 30–34, usually 32; cleithral process enlarged, its posterior margin extending beyond posterior border of second scale in lateral series; first dorsal ray not notably different from second ray; lacrimal pores 2–5, typically 4; ocellus on dorsal fin well developed in female and juvenile (small males up to at least 37 mm SL may have remnant of ocellus).

Holotype.—UMMZ 179638, an adult male 37.4 mm SL from spring-fed pond at El Potosí, Nuevo León, 18 km N of jet of highways 31 and 57 and 3.5 km E of hwy 57, 24° 51' N lat, 100° 19' W long, elev. 1,900 m; collected by R. R. Miller and H. L. Huddle, 23 February 1961. There are 314 young to adult paratopotypes, UMMZ 179639, 11–58 mm, taken with the holotype. An additional 244 paratypes, ENCB P. 890 (27), 13–34, and UMMZ 189021 (217), 14–59 mm, were obtained from the type locality.

Fin rays: dorsal 10–12, usually 10 or 11; anal 9–11, usually 10; pectoral 13–17, usually 15 or 16; pelvic 5–7, typically 6; caudal 16–20, usually 17–19. Lateral scales 24–26, predominately 25; dorsal to anal 10–12, usually 11 or 12; around caudal peduncle 14–16, predominantly 16; around body 30–34, typically 32. Gill rakers 16–20, usually 17–19. Vertebrae 26 or 27, predominantly 26. Head pores: mandibular invariably 2; lacrimal 2–5, usually 4, frequently 3; preopercular 6–8, predominantly 7. Branchiostegals 5 or 6, predominantly 5.

Measurements of holotype in thousandths of standard length: predorsal length 559, prepelvic length 586, preanal length 698, anal origin to caudal base 374, dorsal origin to caudal base 503, body depth 441, body width 238, head length 337, head width 243, head depth 350, caudal-peduncle length 251, caudal-peduncle depth 211, bony-interorbital width 120, snout length 104, orbit length 94, mouth width 118, mandible length 115, depressed-dorsal length 307, basal length of dorsal 211, depressed-anal length 246, basal length of anal 134, length middle caudal rays 246, pectoral length 238, basal width of pectoral 99, pelvic length 102.

Distribution.—This species is known only from the isolated spring at El Potosí, Nuevo León (see Miller and Walters, 1972: Fig. 5), where it is now rare owing to the introduction of largemouth bass in 1974.

It is a pleasure to name this pupfish for my friend José Alvarez del Villar who collected this species in 1952 and had intended to describe it but turned over the study to me. His contributions to Mexican ichthyology span a period of 30 years.

Cyprinodon meeki, new species

Mezquital pupfish

Figure 1E

Cyprinodon latifasciatus (misidentification) Meek, 1904, op. cit.: xxxvii, 126 (material from Labor and Durango, in Río Mezquital basin).

Cyprinodon bovinus (misidentification) Regan, 1906–08, op. cit.: 83–84 (material from Labor and Durango only).

Cyprinodon bovinus latifasciatus (misidentification) Buen, 1947, An. Inst. Biol. Méx., 18 (1): 277 (synonymized with *bovinus*; Río Mezquital material only).

Diagnosis.—Dorsal fin of nuptial male dark dusky (not yellow) in life, becoming blackish sometimes distally and sometimes basally, the terminal black caudal-fin bar narrow (width subequal to or less than diameter of pupil, more than 1.5 in orbit); vertical bars nowhere evident in either young or adult, the general color tone dark; body of female much spotted, the spots small and forming lengthwise rows between or along the scale rows (spots often more or less fused to form an axial stripe); ocellus of dorsal fin of adult female large and constantly present, a moderate to weak ocellus often present also on anal fin; outline of body more rounded than in the other species; gill rakers 12–15; lateral scales usually 25, those around body usually 26, and around caudal peduncle typically 16; mandibular pores consistently lacking; lacrimal pores usually lacking; cleithral process enlarged (as in *eximius* and *nazas*).

Holotype.—UMMZ 197420, a nuptial male 37.6 mm SL, from a pond fed by hot springs, tributary to Río del Tunal, about 9 km E of Durango City, Durango, México, elev. about 1,880 m; collected by S. H. Weitzman and J. D. Latin, 3 August 1952 (pond 20.5°C, hot springs 29.5°C). There are 258 juvenile to adult paratopotypes (UMMZ 166709, 89; CAS 33901, 169), 11–44 mm, taken with the holotype. The following are designated as paratypes: UMMZ 167727 (13), UMMZ 196789 (4), and FMNH 9076 (5), 15–53 mm, Río de la Saucedá at or near Labor, 12.8 km NE of Durango City; UMMZ 179649 (1), 31, warm spring near type locality; UMMZ 192458 (96), 14–40, Río de la Saucedá, 22 km N of Durango City just below dam; FMNH 4388 (68), 23–35, Río del Tunal at Durango City; and CAS 33899 (27), 17–37, Río Canatlán, 17 km N of Durango City, Durango.

Fin rays: dorsal 8–11, usually 9 or 10; anal 9–11, usually 10; pectoral 13–16, usually 15 but frequently 14; pelvic 6 or 7, predominantly 6; caudal 15–18, usually 16. Lateral scales 24–26, typically 25; dorsal to anal 9–11, usually 10 or 11; around caudal peduncle 14–16, predominantly 16; around body 24–28, usually 26. Gill rakers 12–15, typically 14. Vertebrae 26 or 27. Head pores: mandibular consistently lacking; lacrimal 0–5, usually 0; preopercular 6–8, usually 7. Branchiostegals 6.

Measurements of holotype in thousandths of standard length: predorsal length 561, prepelvic length 566, preanal length 678, anal origin to caudal base 383, dorsal origin to caudal base 529, body depth 439, body width 245, head length 332, head width 242, head depth 383, caudal-peduncle length 261, caudal-peduncle depth 218, bony-interorbital width 122, snout length 101, orbit length 88, mouth width 120, mandible length 90, depressed-dorsal length 319, basal length of dorsal 199, depressed-anal length 253, basal length of anal 120, length middle caudal rays 226, pectoral length 242, basal width of pectoral 90, pelvic length 117.

Distribution.—This species is confined to the upper part of the Río Mezquital drainage (Río del Tunal and Río de la Saucedá—see map in Conant, 1963), a Pacific-slope stream near Durango City, Durango, México.

The Mezquital pupfish is named for Seth Eugene Meek who 75 years ago pioneered in exploring the Mexican freshwater fish fauna (Miller, 1976a).

Cyprinodon macrolepis, new species

Largescale pupfish

Figure 1F

Cyprinodon sp. ("probably new") Hubbs and Springer, 1957, Texas J. Sci., 9(3): 314 (descr. of spring and outlet).

Diagnosis.—Dorsal fin of nuptial male yellow on outer half, the terminal caudal-fin bar narrow (width less than diameter of pupil), and remainder of caudal fin without pigment on interradial membranes in both sexes; lateral scales 23 or 24 (fewer even than those of the dwarf hot-spring species, *C. diabolis*, which usually has 24 or 25), those around body 24 or 26, and around caudal peduncle 14 or 16; vertebrae typically 25; gill rakers 17–22; mandibular pores consistently lacking; lacrimal pores irregular, 0–6; cleithral process only moderately enlarged; branchiostegals 6.

Holotype.—UMMZ 168982, a nuptial male 38.9 mm SL, from El Ojo de la Hacienda Dolores, a hot spring (winter–summer temperature variation 29°–33°C) 12.5 km SSW of Jiménez, Chihuahua, México, elev. 1,405 m; collected by Clark Hubbs and Victor G. Springer, 30 June 1954; salinity 0.5 ppt. There are 135 young to adult paratopotypes, 12–43 mm, UMMZ 168983, taken with the holotype. The following are paratypes: UMMZ 168981, 40, 17–40 mm, from an irrigation ditch 1.6 km N of the type locality; and UMMZ 196736, 789, 12–40 mm, from the type locality.

Fin rays: dorsal 10 or 11, usually 10; anal 9–11, usually 10; pectoral 14–17, usually 15 or 16; pelvic 0–7, usually 6; caudal 15–19, usually 16 or 17. Lateral scales 23 or 24; dorsal to anal 9 or 10; around caudal peduncle 13–16, usually 14 or 16; around body 24–26, usually 24 or 26. Gill rakers 17–22,

usually 19 or 20. Vertebrae 24–26, usually 25. Head pores: mandibular invariably 0; lacrimal 0–6, 0, 2, 4 or 5; preopercular 5–8, usually 6. Branchiostegals 6, rarely 5.

Measurements of holotype in thousandths of standard length: predorsal length 586, prepelvic length 571, preanal length 684, anal origin to caudal base 378, dorsal origin to caudal base 506, body depth 437, body width 229, head length 345, head width 242, head depth 345, caudal-peduncle length 249, caudal-peduncle depth 211, bony-interorbital width 141, snout length 118, orbit length 87, mouth width 123, mandible length 93, depressed-dorsal length 316, basal length of dorsal 206, depressed-anal length 247, basal length of anal 131, length middle caudal rays 219, pectoral length 234, basal width of pectoral 98, pelvic length 103.

Distribution.—This species is confined to the large spring-fed pool (tadpole-shaped, 50 m wide at head and ca. 80 m to where it narrows) and its outflows 12.5 km by road south-southwest of Jiménez (see Hubbs and Springer, op. cit.: Fig. 9). Although this spring outflow no doubt once connected with the adjacent Río Florido (of the Río Conchos basin), the pupfish found there (at Jiménez, Fig. 1 herein) is clearly a very different species from this one.

The name *macrolepis* refers to the large scales, so distinctive of this pupfish.

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Abbreviations used are: CAS (California Academy of Sciences), ENCB (Escuela Nacional de Ciencias Biológicas, Mexico City), FMNH (Field Museum of Natural History), TU (Tulane University), UMMZ (University of Michigan Museum of Zoology), UNL (Universidad Autónoma de Nuevo León, Monterrey), and USNM (National Museum of Natural History).

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